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EXAMINER	
BLAN, NICOLE R	
ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com

Office Action Summary	Application No.	Applicant(s)
	10/607,905	PAVONE, SALVATORE
	Examiner	Art Unit
	NICOLE BLAN	1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 April 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *25-64* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *25-64* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 15, 2009 has been entered.

Response to Arguments

2. Applicant's arguments, with respect to the imposed restriction election mail March 24, 2009 have been fully considered and are persuasive. The previous restriction has been withdrawn.

3. Applicant's arguments with respect to claims have been considered but are moot in view of the new ground(s) of rejection.

Specification

4. The amendment filed January 15, 2009 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows:

In the newly amended paragraph 21, line 5, the subject matter not support by the original disclosure is "... CxFy with y > 6 ...". The specification does not give full disclosure to the use of all fluorocarbons where y > 6. The specification only cites gases wherein y = 8.

Applicant is required to cancel the new matter in the reply to this Office Action.

Claim Objections

5. Claims 26, 48 and 56 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. These claims all contain octafluorotetrahydrofuran (C_4F_8O) which does not meet the formula present (CxFy) in the previous claim, namely 25, 47 and 55, respectively. Thus, claims 26, 48 and 56 fail to further limit the subject matter by incorporating chemicals of a different formula.

Claim Rejections - 35 USC § 112

6. Claims 25-45, 47-54 and 55-64 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

7. In claim 25, line 4, the subject matter not properly described in the application as filed is "… CxFy with y > 6 …". The specification does not give full disclosure to the use of all fluorocarbons where y > 6. The specification only cites gases wherein y = 8.

In claims 27 and 30, lines 1-3, the subject matter not properly described in the application as filed is "… the third flow rate setting about 60% of the first flow rate setting; and the third chamber pressure setting is less than 30% of the firs chamber pressure setting." The specification states that the third flow rate is 60% less than the first and second flow rates, or in other words, the third flow rate is 40% of the first and second flow rates. The specification never mentions that the third chamber pressure setting is less than 30% of the first chamber pressure setting. Therefore, this does not teach that the third flow rate setting is 60% of the first flow rate setting or the percentage of the third chamber setting.

Claims 26, 28, 29 and 31-45 are rejected under 35 U.S.C. 112, first paragraph as being dependent upon a rejected claim.

8. In claim 47, line 2, the subject matter not properly described in the application as filed is "… CxFy with $x > 2$ and $y > 6$ …". The specification does not give full disclosure to the use of all fluorocarbons where $x > 2$ and $y > 6$. The specification only cites gases wherein $x = 3$ or $x = 4$ and $y = 8$.

Claims 48-54 are rejected under 35 U.S.C. 112, first paragraph as being dependent upon a rejected claim.

9. In claim 55, line 11, the subject matter not properly described in the application as filed is "… CxFy with $y > 6$ …". The specification does not give full disclosure to the use of all fluorocarbons where $y > 6$. The specification only cites gases wherein $y = 8$.

In claim 57, lines 1-2, the subject matter not properly described in the application as filed is "… the third flow rate setting about 60% of the first flow rate setting …". The specification states that the third flow rate is 60% less than the first and second flow rates, or in other words, the third flow rate is 40% of the first and second flow rates. The specification never mentions that the third chamber pressure setting is less than 30% of the first chamber pressure setting. Therefore, this does not teach that the third flow rate setting is 60% of the first flow rate setting or the percentage of the third chamber setting.

Claims 56 and 58-64 are rejected under 35 U.S.C. 112, first paragraph as being dependent upon a rejected claim.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. Claims 25-42 and 46-63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seamons et al. (U.S. Patent 6,060,397, hereinafter '397) in view of Law et al. (U.S. Patent 4,960,488, hereinafter '488), in view of Jeon (U.S. Patent 6,305,390, hereinafter '390), and further in view of Kil et al. (Korean Patent 1020010055436, hereinafter KR '436).

Claims 25-31 and 34: '397 teaches an in-situ cleaning of residues for a CVD chamber comprising introducing a perfluorocarbon gas under the certain cleaning conditions inside the chamber and detecting endpoint of cleaning. As a perfluorocarbon gas, C_3F_8 (reads on claim 26) is specifically recited (col.4, lines 30-34; col. 10, lines 26-36, 48-62). '397 also indicates that the cleaning method may be performed using a multi-step cleaning process wherein electrode spacing is adjusted to selectively clean inner and outer surfaces of the interior wall of the chamber and other surfaces. While indicating a multi-step cleaning process, '397 remains silent about modifying the pressure as currently specified in the instant claim. '488 teaches an effective multi-step CVD chamber self cleaning process, which includes adjusting the electrode

spacing in order to selectively clean electrodes and nearby chamber components under high pressure (localized cleaning) and clean the more distant areas of the chamber at lower pressure (col. 2, lines 17-21; paragraph, bridging col. 11 and 12; col.15, lines 3-5). Therefore, '488 teaches that modifying the pressure and spacing within the chamber will clean selective portions within the chamber, namely that a higher pressure at a lower spacing would remove residues not completely removed by other applications of a cleaning gas at different pressures and spaces. Therefore, since '397 is concerned with multi-step cleaning of CVD chamber and '488 teaches using multiple processing steps at different pressures and spacing to effectively clean the CVD chamber, one skilled in the art motivated by '488 would have found obvious to utilize the teaching of modifying pressures within the chamber in '488 in order to effectively clean residues from interior surfaces of CVD chamber in the multi-step cleaning process of '397 with a reasonable expectation of success.

They do not teach a three step cleaning process occurring in any order in which the second pressure is greater than the first pressure and the first pressure is greater than the third pressure. However, '390 teaches a three step in-situ plasma cleaning process in which the first cleaning [reads on the "second cleaning" in claim 25], the second cleaning [reads on the "first cleaning" in claim 25], and the third cleaning [reads on the "third cleaning" in claim 25] occur at different pressures so as to ensure the entire chamber is cleaned. The first pressure is greater than the second pressure which is greater than the third pressure. See at least: abstract; col. 1, lines 50-60; col. 2, lines 8-10; col. 2, lines 24-47; col. 3, line 58 – col. 4, line 15. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to clean the chamber of modified '397 using the three step cleaning process of '390 with a

reasonable expectation of success because '390 teaches that it is known to modify the pressure in the chamber during cleaning to ensure the entire chamber is cleaned.

'390 teaches that the RF power is adjusted according to the plasma characteristics [col. 4, lines 12-13]. Thus, the RF power within the chamber is a result effective variable. The RF power required for cleaning the chamber is dependent upon the pressure within the chamber. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the RF power based on the pressure of the chamber, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

'390 teaches that the cleaning time is adjusted based on the RF power within the chamber [col. 4, lines 12-14]. Thus, the time period in which the surface is contacted for cleaning is a result effective variable. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the cleaning time, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The flow rate of the cleaning gases applied to the surface is a result effective variable. The flow rate required could be dependent upon many factors such as the volume of the chamber so that resources can be conserved and production costs can be kept at a minimum so that extra cleaning gas is not being wasted. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate

amount of the cleaning solution based on the size of the chamber to be cleaned for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

They do not explicitly teach that the plasma deposition apparatus has multiple showerheads at respective multiple wafer stations. However, KR '436 teaches that it is known to have a showerhead positioned over each substrate station with in a plasma deposition apparatus [see abstract and Figure on last page of the reference]. Therefore, it would have been obvious to an ordinary artisan to use individual showerheads for each station as taught by KR '436 in modified method of '397 because KR '436 illustrates that processing multiple wafers at once would improve yield and productivity.

Claim 32: '397, '488, '390 and KR '436 teach the limitations of claim 31 above. With regard to the limitation reciting that a duration of the third cleaning step is a function of the duration of the first cleaning step, one skilled in the art would have found it obvious to establish such function since the third cleaning step is used as the final cleaning step, the effectiveness of which obviously depends on the cleanness of the localized areas of CVD chamber, performed by the first cleaning step.

Claim 33: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 31 above. With regard to the limitation that the third duration is a fixed time plus a fraction of the first duration, one skilled in the art would have found it obvious that the third duration is a set time plus an extended amount of time to ensure that the chamber is entirely cleaned. This way the chamber does not contain any remaining residues by extending the final cleaning step.

Claim 35: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 25 above. ‘397 teaches CVD chamber cleaning wherein endpoint is determined by monitoring the presence of selected radicals in the plasma from fluorine [reads on “change in concentration of the cleaning by-products”; col. 5, lines 33-39; col. 6, lines 35-67; col. 7, lines 1-5].

Claims 36 and 37: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 25 above. ‘397 teaches CVD chamber cleaning wherein endpoint is determined by monitoring an increase in fluorine where the changes in fluorine are determined by measuring optical emission signals at 704 nanometers [col. 5, lines 33-39; col. 6, lines 35-67; col. 7, lines 1-5].

Claim 38: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 25 above. The order in which the cleaning takes place using a three step cleaning process where the second pressure is greater than the first pressure and the first pressure is greater than the third pressure is discussed in claim 25 above. They do not explicitly teach that pressure or flow rates of the three steps. The pressure of the chamber is a result effective variable. The pressure required is dependent upon many factors such as the temperature at which the chamber is maintained or the

volume of the chamber itself. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the pressure of the chamber, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The flow rate of the cleaning gases applied to the surface is a result effective variable. The flow rate required could be dependent upon many factors such as the volume of the chamber so that resources can be conserved and production costs can be kept at a minimum so that extra cleaning gas is not being wasted. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate amount of the cleaning solution based on the size of the chamber to be cleaned for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claim 39: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 38 above. As discussed above, ‘390 teaches that the RF power is adjusted according to the plasma characteristics [col. 4, lines 12-13]. Thus, the RF power within the chamber is a result effective variable. The RF power required for cleaning the chamber is dependent upon the pressure within the chamber. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the RF power based on the pressure of the chamber,

since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claim 40: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 38 above. ‘397 also teaches passing oxygen together with the perfluorocarbon gas into the chamber during cleaning [col. 6, lines 11-16].

Claims 41 and 42: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 40 above. The concentration of the cleaning gas is a result effective variable. The concentration required could be dependent upon many factors such as the type of contaminant to be removed (e.g. a greater concentration may be required to remove certain contaminants) and the quantity/size of the contaminants to be removed. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate concentration of the cleaning gas based on the contaminants to be removed for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The flow rate of the cleaning gases applied to the surface is a result effective variable. The flow rate required could be dependent upon many factors such as the volume of the chamber so that resources can be conserved and production costs can be kept at a minimum so that extra

cleaning gas is not being wasted. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate amount of the cleaning solution based on the size of the chamber to be cleaned for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 46-50: '397 teaches an in-situ cleaning of residues for a CVD chamber comprising introducing a perfluorocarbon gas under the certain cleaning conditions inside the chamber and detecting endpoint of cleaning. As a perfluorocarbon gas, C_3F_8 (reads on claims 47 and 48) is specifically recited (col.4, lines 30-34; col. 10, lines 26-36, 48-62). '397 also indicates that the cleaning method may be performed using a multi-step cleaning process wherein electrode spacing is adjusted to selectively clean inner and outer surfaces of the interior wall of the chamber and other surfaces. While indicating a multi-step cleaning process, '397 remains silent about modifying the pressure as currently specified in the instant claim. '488 teaches an effective multi-step CVD chamber self cleaning process, which includes adjusting the electrode spacing in order to selectively clean electrodes and nearby chamber components under high pressure (localized cleaning) and clean the more distant areas of the chamber at lower pressure (col. 2, lines 17-21; paragraph, bridging col. 11 and 12; col.15, lines 3-5). Therefore, '488 teaches that modifying the pressure and spacing within the chamber will clean selective portions within the chamber, namely that a higher pressure at a lower spacing would remove residues not

completely removed by other applications of a cleaning gas at different pressures and spaces. Therefore, since '397 is concerned with multi-step cleaning of CVD chamber and '488 teaches using multiple processing steps at different pressures and spacing to effectively clean the CVD chamber, one skilled in the art motivated by '488 would have found obvious to utilize the teaching of modifying pressures within the chamber in '488 in order to effectively clean residues from interior surfaces of CVD chamber in the multi-step cleaning process of '397 with a reasonable expectation of success.

They do not teach a three step cleaning process occurring in any order in which the second pressure is greater than the first pressure and the first pressure is greater than the third pressure. However, '390 teaches a three step in-situ plasma cleaning process in which the first cleaning [reads on the "third cleaning" in claim 46], the second cleaning [reads on the "first cleaning" in claim 46], and the third cleaning [reads on the "second cleaning" in claim 46] occur at different pressures so as to ensure the entire chamber is cleaned. The first pressure is greater than the second pressure which is greater than the third pressure. See at least: abstract; col. 1, lines 50-60; col. 2, lines 8-10; col. 2, lines 24-47; col. 3, line 58 – col. 4, line 15. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to clean the chamber of modified '397 using the three step cleaning process of '390 with a reasonable expectation of success because '390 teaches that it is known to modify the pressure in the chamber during cleaning to ensure the entire chamber is cleaned.

'390 teaches that the RF power is adjusted according to the plasma characteristics [col. 4, lines 12-13]. Thus, the RF power within the chamber is a result effective variable. The RF power required for cleaning the chamber is dependent upon the pressure within the chamber.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the RF power based on the pressure of the chamber, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

'390 teaches that the cleaning time is adjusted based on the RF power within the chamber [col. 4, lines 12-14]. Thus, the time period in which the surface is contacted for cleaning is a result effective variable. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the cleaning time, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The flow rate of the cleaning gases applied to the surface is a result effective variable. The flow rate required could be dependent upon many factors such as the volume of the chamber so that resources can be conserved and production costs can be kept at a minimum so that extra cleaning gas is not being wasted. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate amount of the cleaning solution based on the size of the chamber to be cleaned for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

They do not explicitly teach that the plasma deposition apparatus has multiple showerheads at respective multiple wafer stations. However, KR '436 teaches that it is known to have a showerhead positioned over each substrate station with in a plasma deposition apparatus [see abstract and Figure on last page of the reference]. Therefore, it would have been obvious to an ordinary artisan to use individual showerheads for each station as taught by KR '436 in modified method of '397 because KR '436 illustrates that processing multiple wafers at once would improve yield and productivity.

Claim 51: '397, '488, '390 and KR '436 teach the limitations of claim 47 above. The order in which the cleaning takes place using a three step cleaning process where the second pressure is greater than the first pressure and the first pressure is greater than the third pressure is discussed in claim 46 above. They do not explicitly teach that pressure or flow rates of the three steps. The pressure of the chamber is a result effective variable. The pressure required is dependent upon many factors such as the temperature at which the chamber is maintained or the volume of the chamber itself. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the pressure of the chamber, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The flow rate of the cleaning gases applied to the surface is a result effective variable. The flow rate required could be dependent upon many factors such as the volume of the chamber so that resources can be conserved and production costs can be kept at a minimum so that extra

cleaning gas is not being wasted. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate amount of the cleaning solution based on the size of the chamber to be cleaned for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claim 52: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 51 above. As discussed above, ‘390 teaches that the RF power is adjusted according to the plasma characteristics [col. 4, lines 12-13]. Thus, the RF power within the chamber is a result effective variable. The RF power required for cleaning the chamber is dependent upon the pressure within the chamber. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the RF power based on the pressure of the chamber, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 53 and 54: ‘397, ‘488, ‘390 and KR ‘436 teach the limitations of claim 40 above. ‘397 also teaches passing oxygen together with the perfluorocarbon gas into the chamber during cleaning [col. 6, lines 11-16]. The concentration of the cleaning gas is a result effective variable. The concentration required could be dependent upon many factors such as the type of

contaminant to be removed (e.g. a greater concentration may be required to remove certain contaminants) and the quantity/size of the contaminants to be removed. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate concentration of the cleaning gas based on the contaminants to be removed for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The flow rate of the cleaning gases applied to the surface is a result effective variable. The flow rate required could be dependent upon many factors such as the volume of the chamber so that resources can be conserved and production costs can be kept at a minimum so that extra cleaning gas is not being wasted. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate amount of the cleaning solution based on the size of the chamber to be cleaned for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 55-59 : '397 teaches an in-situ cleaning of residues for a CVD chamber comprising introducing a perfluorocarbon gas under the certain cleaning conditions inside the chamber and detecting endpoint of cleaning. As a perfluorocarbon gas, C_3F_8 (reads on claim 56)

is specifically recited (col.4, lines 30-34; col. 10, lines 26-36, 48-62). ‘397 also indicates that the cleaning method may be performed using a multi-step cleaning process wherein electrode spacing is adjusted to selectively clean inner and outer surfaces of the interior wall of the chamber and other surfaces. While indicating a multi-step cleaning process, ‘397 remains silent about modifying the pressure as currently specified in the instant claim. ‘488 teaches an effective multi-step CVD chamber self cleaning process, which includes adjusting the electrode spacing in order to selectively clean electrodes and nearby chamber components under high pressure (localized cleaning) and clean the more distant areas of the chamber at lower pressure (col. 2, lines 17-21; paragraph, bridging col. 11 and 12; col.15, lines 3-5). Therefore, ‘488 teaches that modifying the pressure and spacing within the chamber will clean selective portions within the chamber, namely that a higher pressure at a lower spacing would remove residues not completely removed by other applications of a cleaning gas at different pressures and spaces. Therefore, since ‘397 is concerned with multi-step cleaning of CVD chamber and ‘488 teaches using multiple processing steps at different pressures and spacing to effectively clean the CVD chamber, one skilled in the art motivated by ‘488 would have found obvious to utilize the teaching of modifying pressures within the chamber in ‘488 in order to effectively clean residues from interior surfaces of CVD chamber in the multi-step cleaning process of ‘397 with a reasonable expectation of success.

They do not teach a three step cleaning process occurring in any order in which the second pressure is greater than the first pressure and the first pressure is greater than the third pressure. However, '390 teaches a three step in-situ plasma cleaning process in which the first cleaning [reads on the “second cleaning” in claim 55], the second cleaning [reads on the “first

cleaning" in claim 55], and the third cleaning [reads on the "third cleaning" in claim 55] occur at different pressures so as to ensure the entire chamber is cleaned. The first pressure is greater than the second pressure which is greater than the third pressure. See at least: abstract; col. 1, lines 50-60; col. 2, lines 8-10; col. 2, lines 24-47; col. 3, line 58 – col. 4, line 15. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to clean the chamber of modified '397 using the three step cleaning process of '390 with a reasonable expectation of success because '390 teaches that it is known to modify the pressure in the chamber during cleaning to ensure the entire chamber is cleaned.

'390 teaches that the RF power is adjusted according to the plasma characteristics [col. 4, lines 12-13]. Thus, the RF power within the chamber is a result effective variable. The RF power required for cleaning the chamber is dependent upon the pressure within the chamber. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the RF power based on the pressure of the chamber, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

'390 teaches that the cleaning time is adjusted based on the RF power within the chamber [col. 4, lines 12-14]. Thus, the time period in which the surface is contacted for cleaning is a result effective variable. Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the cleaning time, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the

optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

The flow rate of the cleaning gases applied to the surface is a result effective variable. The flow rate required could be dependent upon many factors such as the volume of the chamber so that resources can be conserved and production costs can be kept at a minimum so that extra cleaning gas is not being wasted. Without evidence of unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to determine the appropriate amount of the cleaning solution based on the size of the chamber to be cleaned for the predictable results of cleaning the chamber of a semiconductor processing system, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

They do not explicitly teach that the plasma deposition apparatus has multiple showerheads at respective multiple wafer stations. However, KR '436 teaches that it is known to have a showerhead positioned over each substrate station with in a plasma deposition apparatus [see abstract and Figure on last page of the reference]. Therefore, it would have been obvious to an ordinary artisan to use individual showerheads for each station as taught by KR '436 in modified method of '397 because KR '436 illustrates that processing multiple wafers at once would improve yield and productivity.

'397 also teaches transferring wafers into a deposition chamber of a CVD tool and depositing layers onto the wafer via a showerhead, removing the wafers and repeating the transferring, depositing and removing steps until the build-up within the chamber reaches a

certain thickness [col. 3, line 67 – col. 4, line 5; col. 4, lines 21-33; col. 5, line 60 - col. 6, line 5]. Then the chamber undergoes an in-situ cleaning process [col. 4, lines 21-33]. As discussed above, KR ‘436 teaches using multiple wafer stations each equipped with its own showerhead. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit layers onto the wafers as taught by ‘397 using the wafer stations and showerheads taught by KR ‘436.

Claim 60 is rejected over ‘397, ‘488, ‘390 and KR ‘436 as applied to claim 56 above and for the reasons applied to claim 38 above.

Claim 61 is rejected over ‘397, ‘488, ‘390 and KR ‘436 as applied to claim 60 above and for the reasons applied to claim 39 above.

Claim 62 is rejected over ‘397, ‘488, ‘390 and KR ‘436 as applied to claim 60 above and for the reasons applied to claims 40 and 41 above.

Claim 63 is rejected over ‘397, ‘488, ‘390 and KR ‘436 as applied to claim 62 above and for the reasons applied to claim 42 above.

13. **Claims 43-45 and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Seamons et al. (U.S. Patent 6,060,397, hereinafter '397) in view of Law et al. (U.S. Patent 4,960,488, hereinafter '488), in view of Jeon (U.S. Patent 6,305,390, hereinafter '390), in view of Kil et al. (Korean Patent 1020010055436, hereinafter KR '436), and further in view of Richardson et al. (U.S. Patent 7,028,696, hereinafter '696).**

Claims 43 and 44: '397, '488, '390 and KR '436 teach the limitations of claim 25 above. '397 teaches monitoring cleaning process by-products, but it does not teach moving from one cleaning step to another in response to this monitored process. However, '696 teaches a multiple step in-situ plasma chamber cleaning process as well as a method of monitoring cleaning process by-products, specifically that of measuring fluorine at 704 nanometers and detecting the endpoint of this cleaning step before proceeding onto the next cleaning step [col. 11, lines 19-49]. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to optically monitor the by-product of the cleaning gas to determine when it is appropriate to move on to the next cleaning step.

Claim 45: '397, '488, '390 and KR '436 teach the limitations of claim 25 above. They do not teach a controller. However, computerized process controllers are conventionally utilized in the art as evidenced by '696. '696 teaches a multiple step cleaning operation controlled by computer to automatically start the wafer-less plasma cleans at set wafer processing intervals. The process parameters are input as a recipe and the process parameters are controlled by a system, such as a programmable logic controller that interfaces with the reaction chamber [col. 7, lines 30-38]. Therefore, one skilled in the art motivated by '696 would have found obvious to

utilize a controller to automate and enhance efficiency of the multi-step chamber cleaning processing modified ‘397.

Claim 64 is rejected over ‘397, ‘488, ‘390 and KR ‘436 as applied to claim 55 above and for the reasons applied to claims 43 and 44 above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NICOLE BLAN whose telephone number is (571)270-1838. The examiner can normally be reached on Monday - Thursday 8-5 and alternating Fridays 8-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Nicole Blan/
Examiner, Art Unit 1792

/Alexander Markoff/
Primary Examiner, Art Unit 1792